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NASA Dryden Flight Research Center

"F–15 Propulsion System", page 1

PW1128 Engine and DEEC

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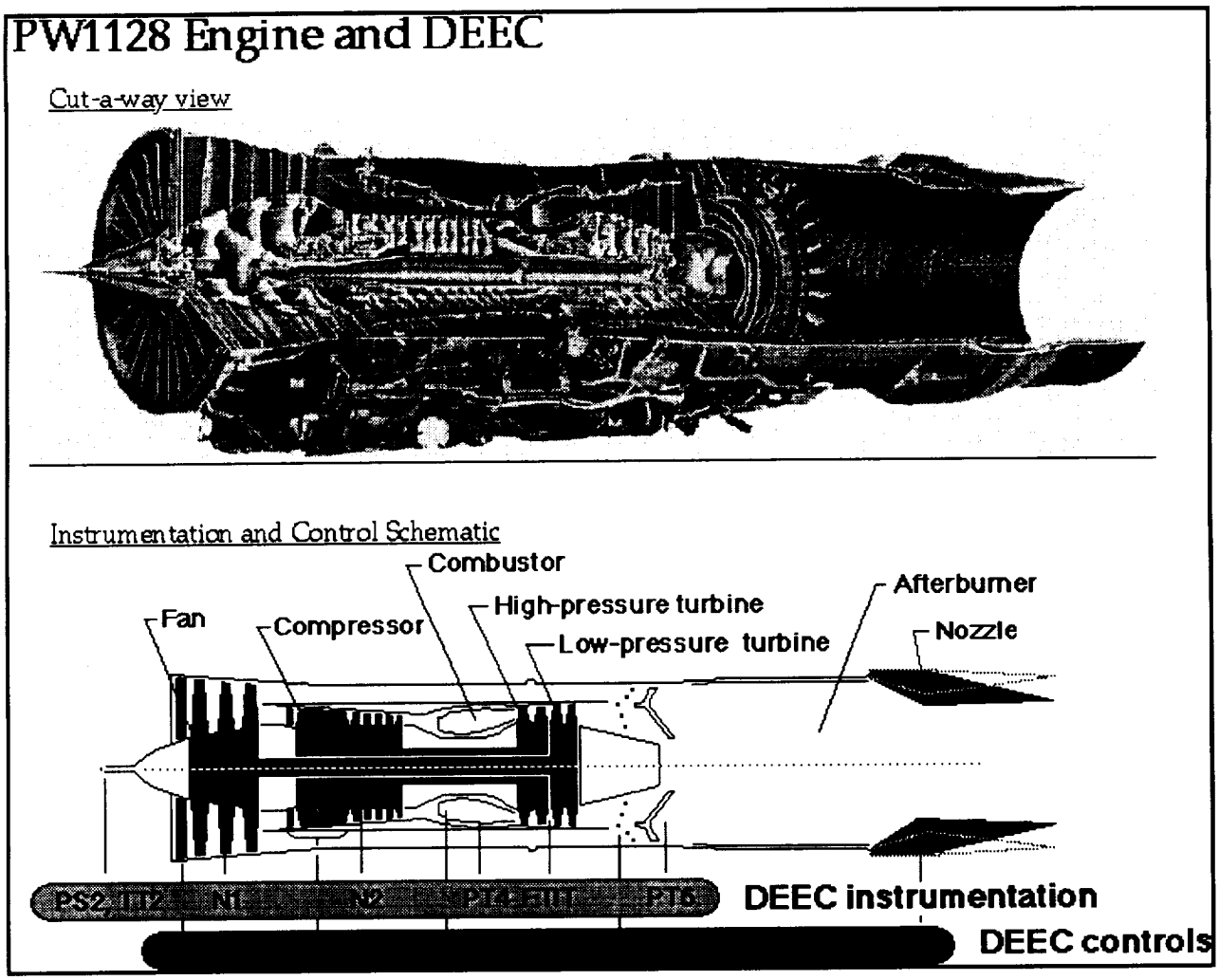

The F–15 is powered by two PW1128 afterburning turbofans which are growth versions of the F100–PW–100 engine. The above schematic shows the engine control effectors and sensor locations. (further details of the PW1128 engine are contained in Myers, et. al., "Digital Electronic Engine Control (DEEC) Flight Evaluation in an F–15 Airplane", NASA CP–2298, Mar 1984).

The PW1128 is controlled by a full–authority Digital Electronic Engine Control (DEEC). The DEEC schedules and maintains engine operating point through the use of two main control loops; the first regulates the scheduled low rotor speed (N1C2) using main burner fuel flow (WF), the second loop controls engine pressure ratio (EPR) with nozzle throat area (AJ). The

DEEC also schedules compressor variable vanes (CIVV) and rear compressor variable vanes (RCVV). The sensed parameters consist of fan speed, N1; high–pressure compressor speed, N2; engine face total temperature, TT2; fan turbine inlet temperature, FTIT; engine face static pressure, PS2; burner pressure, PT4; and augmentor total pressure, PT6. All pertinent parameters used by the DEEC for engine control are transmitted via a RS422 UART bus to the on–board computers for use by the PSC algorithm.

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F-15 Air Induction System

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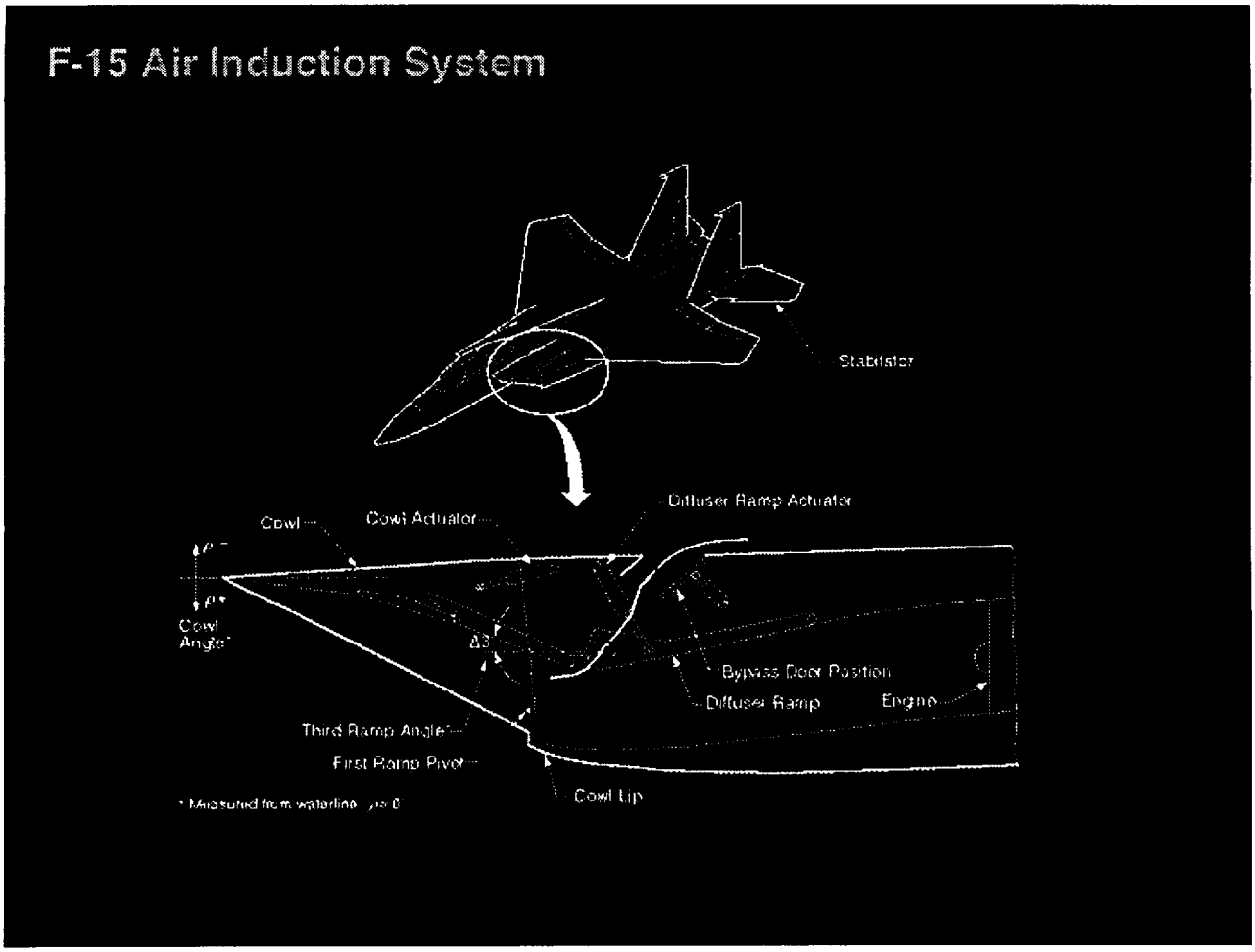

The F-15 inlet is a two-dimensional, three-ramp, external compression design with partially cut back side plates. During supersonic operation, compression is accomplished through three oblique shocks and one terminal normal shock. The three compression ramps are all variable. Separate cowl and diffuser ramp actuators provide independent control of the first and third ramps. The second ramp position is dependent on the first and third ramp positions. This approach gives the F-15 inlet a unique variable capture feature that minimizes inlet spill drag. The inlet also incorporates a variable bypass system for inlet/engine matching.

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Inlet Control System

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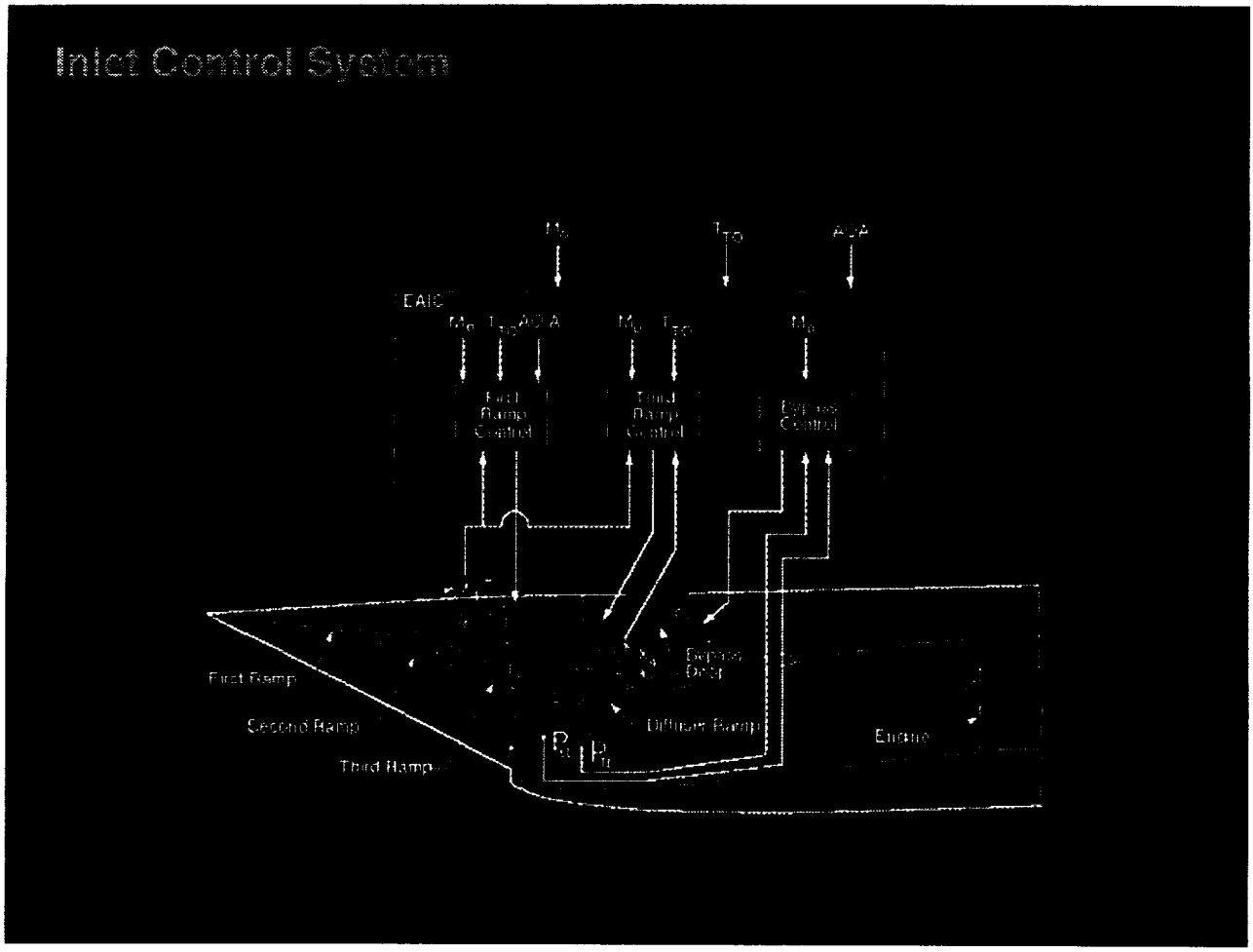

Each inlet is independently controlled by an Electronic Air Inlet Controller (EAIC). The EAIC control logic positions the actuators to yield the scheduled first ramp, third ramp and bypass door positions for the given flight condition and angle of attack (AOA). The first ramp is scheduled with aircraft Mach number, free–stream total temperature and AOA. The third ramp is scheduled with aircraft Mach number and free–stream total temperature. The bypass door is scheduled with free–stream Mach number and inlet duct Mach number. The first and third ramp schedules are designed to maximize inlet and aircraft performance while maintaining stable inlet operation. The bypass door schedule is designed to provide additional inlet stability when it is required.

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